The communication of radon risk in Sweden: Where are we and where are we going?

By

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Abstract

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1. Introduction

Sweden has a substantial problem with radon, a naturally occurring radioactive, colorless, odorless and tasteless gas that can cause lung cancer. There are three primary sources of radon (Swedish National Board of Housing and Planning 2010b) (abbreviated as SNBHP):

- emissions from the ground/bedrock;
- the water from drilled wells in radon rich areas;
- certain concrete building materials--in the period 1929-late 1970s Swedish building companies used so called blue concrete that is alum shale based and contains high levels of radium;

Radon is an especially big problem in Sweden as not only do homes conform to strict energy conservation measures (both in terms of triple pane windows, cavity wall insulation and attic insulation) but also due to the cold climate homes have low air exchange rates as windows and doors are seldom opened during the heating period (Mjones et al 2009). Exposure to radon is aggravated by the fact that during the long cold and dark winter months inhabitants spend most of their leisure hours at home (Schipper and Lichtenberg 1976; Schipper et al 1985). Current binding guidelines for new built homes are set at a maximum of 200 Bequerels per cubic meter of air (Bq/m3) while for existing homes there is a recommended guideline set at 200 Bq/m3 (SNBHP 2016; The Swedish Public Health Agency 2014). Yet just a few years ago, a number of Swedish schools reported radon levels of 3200 Bq/m3 and in a search for buildings with high radon levels one family home reported levels of 28,000 Bq/m3 (Swedjemark 1988).

Radon gas, to which individuals are mostly exposed in their own homes, is the second biggest cause of lung cancer in the country (after smoking). In one study (Swedish Radiation Safety Authority 2012) the Swedish Radiation Safety Authority calculated that of the 3,500 annual lung cancer deaths some 500 cases are caused by the exposure to high levels of radon gas. Most radon-induced lung cancers occur in those who already smoke. One study showed that a smoker has approximately 25 times higher chance of getting lung cancer from radon than a non-smoker (Darby et al 2005; Mjones et al 2009). In other words, approximately 450 of the 500 estimated annual radon-induced lung cancer deaths are among individuals who already smoke (Swedish National Board of Housing and Planning 2016).

It is rather easy to prevent radon induced lung cancer (US EPA 2017). Studies indicate that for every exposure of 100Bq/m3 lung cancer risk increases by 16 percent (Darby et al 2005; see also Axelsson et al 2015). As a result, it should come as no surprise when the World Health Organisation (WHO) came out with a major study on radon noting that there should be an upper exposure limit of 100 Bq/m3, which was 50 percent lower than the Swedish guidance in effect at that time (WHO 2009). In 2010 the Swedish National Board of Housing Building and Planning in collaboration with five other Government Agencies conducted an economic analysis to see whether it would make economic sense to meet the WHO guidance. It concluded that approximately 400,000 small domestic dwellings and 230,000 flats had radon levels between 100-200 Bq/m3 of air, and therefore a proposed clean-up of these dwellings would affect 1.3 million individuals. The costs of the proposed radon clean-up were estimated at a one off fee of 14-19 billion SEK plus an annual cost of an additional 500 million SEK. These proposed measures would only save some 40 lives per year. As a result the Swedish National Board of Housing and Planning rejected calls to reduce the upper exposure limit to 100Bqm3 air (SNBHP 2010).

One of Swedish National Board of Housing and Planning's main concerns historically-has been-and still is to reduce the levels of radon below 200 Bq/m3 for all dwellings by the year 2020. This is something that the Government originally asked the Agency to prioritize as clearly highlighted in the 2001 Swedish Government Bill which states:

> "by the year 2020 all houses should not affect human health negatively…that radon levels in all houses by the year 2020 is lower than 200Bq/m3 air." (Swedish Government Bill 2001/02:1218).

Although a number of the Government's goals were changed somewhat in the it's bill from 2010 the above one remained (Swedish Government Bill 2010). The aim of this paper is to examine whether the SNBHP will reach this goal by conducting an evaluation of its actions from a risk communication perspective.

Will all Swedish dwellings come in under 200Bq/m3 air by 2020 as stated in the Swedish Government Bill of 2001? The paper is based on 12 face to face interviews with members of SNBHP in Karlskrona, Sweden as well as an evaluation and analysis of the grey literature (both in-house and consultant studies that have not undergone peer review) on the topic. The study was conducted between January-June 2017. In the next section I briefly review the risk communication literature associated with radon, and discuss in some detail what the Board has done within the radon communication area with a specific focus on the 2005-2006 radon information/communication campaign. This is followed by an analysis of what the Board did followed by a series of recommendations that the Board may wish to adapt going forward.

2. Risk communication and radon

There has been quite a few studies done on radon communication (Guimond and Page 1992). Most of the historic radon research was funded by the United States Radon Program which was set up by the US Environmental Protection Agency in 1985 following nationwide media coverage of an individual triggering a radiation detector in December 1984 at a nuclear station because his home was contaminated by radon (Guimond and Page 1992). This EPA and related research on the topic uncovered a number of reasons to why radon risk communication is rather difficult to do. Among the key variables include (after Guimond and Page 1992, p. 170-173; also see Bostrom et al 1992; Fisher and Johnson 1990; Fisher and Sjoberg 1990;Fischhoff et al 1979; Sjoberg 1989; Slovic 1987; 1997; Smith et al 1987; Svenson and Fischhoff 1985; Weinstein et al 1989):

- Radon is a colorless, odorless and tasteless gas and as such is not easily perceptible;
- A person's individual home is perceived as safe;
- Radon is seen as a voluntary rather than an involuntary risk;
- Cancer is caused by a multitude of reasons including air pollution and genetics. It is difficult to prove that one has developed lung cancer from indoor radon pollution;
- Radon is an example of a chronic rather than an acute risk. Symptoms are not immediately recognized;
- The risks of radon are not evenly spread—some areas have higher levels of radon than others;
- Radon is seen as a natural hazard rather than a technological one.

Because of these communication issues few individuals voluntarily test their homes for radon (Guimond and Page 1992).

3. Background

Since 1988 the Swedish Government asked the National Board of Housing and Planning's to administer the radon reduction fund (Radonbidraget) which has been the main tool to reduce radon in homes (Swedish National Board of Housing and Planning1988: 372). In the 2005-2012 time period the budget for this fund was set at 33 million SEK per year. This Government subsidy is used to part fund the sanitization of radon contaminated homes. In order to get the houses sanitized, however, the levels of radon in people's homes first have to be measured. These measurements take at least two months and have to be done during the Swedish "heating season" (when a majority of homes are being heated as it is cold outside) lasting from 1st October to 30th April. If high levels of radon are detected, counter measures are introduced to reduce the level of radon (such as greater levels of ventilation) and then measurements are taken again to see if radon levels have decreased. For the Swedish National Board of Housing and Planning to succeed in reducing the levels of radon in people's homes individuals need to apply for the radon reduction fund once measurements have been made.

In 2004 the Swedish National Board of Housing and Planning was concerned that only approximately half of the radon subsidy budget had been taken up by concerned homeowners per year. Something needed to be done to increase public awareness of radon so as to encourage home owners to measure radon levels in their houses and if levels are elevated to get their homes sanitized. The Board persuaded the Swedish Government to allow it to spend 5 million Swedish crowns as a one-off information/communication campaign (Trivector Information 2006).

4. The 2005-2006 radon communication/information campaign

The Board's radon campaign was carried out between October 2004 and February 2006 (Trivector Information 2006). That said, it was rather slow to get going. Between October 2004 and May 2005, the radon communication working group was busy collecting material for the campaign itself. In this pre-phase the most important study was produced by Nordisk Kommunikation which was tasked to provide an analysis on how the Swedish National Board of Housing should actually communicate the risks associated with radon to the general public (Nordisk Kommunikation 2005). So it was not technically until May 2005 that the campaign officially launched. The campaign itself was composed of the following:

- May 2005: Meeting with journalists at the Board's headquarters in Karlskrona;
- June 2005: A "news note" was sent to all of Sweden's County Councils and municipalities;
- June 2005: The Board had a meeting with other affected Federal agencies regarding the forthcoming radon campaign;

- September 2005: A sizeable radon "information package" (containing brochures, CD-rom, fridge magnets and posters) was distributed to all of Sweden's municipalities and county councils;
- September 28th 2005: A dedicated webpage www.radonguiden.se became established and was supposed to serve as the focal risk communication mechanism of the campaign. All the other elements of the campaign pushed the Swedish public to visit this website;
- November 1st ,2005: One press release is published on radon and the importance of measuring radon levels in homes;
- December 14, 2005: Advertisements about the dangers of radon was placed in 12 newspapers with the last advertisement being placed;
- December 21st- 11th February 2006: Information on the Swedish Television's "Anslagstavlan" which on average is viewed by 190,000 Swedes;

Following the completion of the radon campaign the Swedish National Board of Housing and Planning asked a number of consultancies to evaluate it in the Spring of 2006. The initial findings were rather mixed. For example, in 247 face-to-face interviews conducted via convenience sampling in four different cities the consultancy Arne Larssen AB found that only 2% of those surveyed knew that the Board was behind the newspaper advertisements (the consultancy had expected 5%) and that only 1% of those asked would consider visiting the radon website (www.radonguiden.se) (Arne Larssen AB 2005). This was confirmed by web analytics which showed that in the period October-December 2015 the website had only 24,284 unique visits or the equivalent of 264 visitors per day. The average visit time was just over 5 minutes (Jansson 2006). This is comparatively low considering that the target audience for the Board was 2.8 million individuals (Trivector Information AB 2006).

Strangely enough, none of these rather poor findings affected the outcome of the radon communication/information campaign. The media element of the campaign, in part triggered by the advertisements in the local media, but more importantly by the active media involvement of the local county council radon officers on the back of the campaign, was hugely successful. The campaign was mentioned an astonishing 11 million times in just over a year leading to an increasing number of Swedes contacting their municipalities and county councils asking for radon measurements (Observer 2006; Trivector Information AB 2006). As Trivector in their meta-analysis consisting of interviews with radon officers at various municipalities/country councils uncovered:

> "We have had 5000-6000 (radon) measurements over the years since we started measurements in Mora/Orsa municipalities in the beginning of the 1990s. And only in the past 6 months during this new measuring season we have had more than 1400 measurements—it is an excellent increase.

> And I have heard the same from other municipalities." (Trivector Information AB 2006, p.26).

Or as another municipal official noted:

> "We see that the Board's campaign has led to more measurements. People have contacted us and want more measurements. We had about 765 measurements conducted under the past season. The year before that we had 500. We think that is rather good." (Trivector Information AB 2006).

In other words the Board's information and communication campaign was a huge success primarily because it focused on communication with radon officers in local municipalities/county councils via local media. The Board also developed information brochures on what radon was and how to combat it, noting among other things that had radon been coloured as a green gas it would have been much easier to communicate (SNBHP 2005) something that had been highlighted in the radon risk communication research carried out in the 1980s and 1990s (Guimond and Page 1992). What happened after the completion of the successful information and communication campaign? That is discussed in the next section.

5. Radon awareness, communication and sanitization post 2004-5 campaign

In the period 2006-2014 the total budget for radon sanitization of people's homes was set at 32.8 million SEK per year. In the period 2006-2010 the communication budget for the radon fund was set at 1.5 million SEK per year. This budget was consistently underspent. Partially as a result of this underspending the Government further reduced the communication/information part of the radon fund to 200,000 SEK per year in the period 2011-2014. Unsurprisingly, the Swedish National Board of Housing and Planning uncovered that there was a direct correlation between how much funding was being spent on communication/information and individuals applying for the radon reduction budget. So the highest level of applications took place in the period 2007-2012 (just after the major 5 million SEK 2005 communication/information campaign) when over 30 million SEK was paid out to homeowners per year and since then application levels were reduced by almost a third to 22.4 million SEK in 2013 (SNBHP 2014). As the application levels declined further the Swedish National Board of Housing and Planning was unable to spend its annual allocated sanitation budget.

This reduction in applications concerned SNBHP. If the Agency could not spend its radon budget, there was a chance that the Government could take the budget away from it. As a result, it decided to conduct two evaluations to better understand why applications levels were reduced, one external and one internal.

The external evaluation, carried out by the consultancy CMA Research AB, focused on examining knowledge and awareness of radon among certain target groups. When the consultancy asked small house owners who had sanitized their homes for radon some 44% of the respondents postulated that small house owners were not aware of the risks associated with radon and another 11% noted that probably these individuals did not know about the radon reduction fund in the first place. When the question was posed to individuals who had not sanitized their homes the figures were 21% and 45% respectively (CMA 2013; SNBHP 2014).

The internal evaluation concluded that the communication/ information budget part of the radon reduction fund part needed to increase and that the subsidy per household originally set at 15,000 SEK was too low and would need to increase as well. Based on these two evaluations the Swedish National Board of Housing and Planning recommended going forward that the communications/information budget should once again increase to 1.5 million SEK per annum and that the maximum amount that each individual could apply for should be raised to 25,000 SEK (SNBHP 2014). Unfortunately for the Swedish National Board of Housing and Planning, however, was that the Swedish Government decided to axe the radon reduction fund in its entirety before the Board could publish its evaluation. Hence at the present time the Swedish National Board of Housing and Planning has no funds to distribute to individuals who want to sanitize their homes from radon.

6. Analysis

Overall the Swedish National Board for Housing and Planning has done an admirable job when it comes to communicating the risks of radon to the general public when a large and an appropriate budget has been place (as was the case of the 2005-2006 campaign). When only a small budget was allocated from the Radon fund for communication purposes then problems occurred. With an appropriate budget in place communication was a success measured in terms of Swedish households seeking the radon subsidy, when it was cut this was no longer the case. That said there are three areas in which the Board needs to address when it comes to radon communication

6,1 Reduce the Agency's reliance on communication consultants

In analyzing the success of the 2005-6 campaign this author was surprised by how reliant the Board was on external communication consultants. The reports, usually based on interviews, media analysis or website analysis were shallow in tone with no proper rigorous analysis. For example, why would only 1% of the individuals in the face-to-face survey visit the website? Questions such as this were not analyzed or even discussed. It is not that radon has been an under researched topic academically (as discussed in section 2). It has been well

documented that persuading the public to get their homes tested for radon is rather difficult to do including the fact that the public perceive radon to be a natural rather than a technological hazard. Had radon gas been associated with some form of human made chemical, for example, it would not have been difficult to sign up Swedes to get their houses measured (see Slovic 1987; 2000). In a way the Board missed an opportunity here. Rather than to commission Nordiskkommunikation to do a study on how radon should be communicated they should have commissioned an academic with expertise in risk communication to do it. The campaign, in such a scenario, would have had a much more solid academic footing.

6.2 Rushed time frame and no long-term communication strategy

Although the successful information/communication campaign was supposed to last an entire year, in actual fact it lasted no more than 5 months. That is too short and something that Trivector Information also picked up on. A year-long campaign would have been preferable for something as difficult as communicating radon advice. For that to have happened the Board should have done all the preparing (brochures, pre-analysis etc) in advance of the launch of the campaign. Related to that it would have been good to see continued communication activities post the 2004-2006 campaign as a way to maintain momentum and to continue reinforcing the radon risk/measuring messages with most of the budget going on promoting local news stories.. Rather in the years that followed the Board was unable to spend the funds allocated for radon communication. For example in the period 2006-2010 the Board was allocated a budget of 1,5 million SEK a year to spend and in that period it spent (after Swedish National Board of Housing and Planning 2014):

2006-1.36 million SEK
2007-0.87 million SEK
2008-0.82 million SEK
2009-1.04 million SEK
2010- 0.24million SEK

6.3 Over reliance on the radon website

The consultancies hired by the Board over promoted the radon website. The aim of all the external communication was too lead concerned homeowners back to the website. This has been done several times before—it happened with the Swedish poison fish campaign conducted by the Swedish Food Agency (see Lofstedt 2018). That said it was rather naïve. The consultancies did not pretest their messages nor analyze the possible reasons why the Swedish public would not want to visit the website in the first place. Had they done a proper analysis, underpinned by the latest academic literature, they would have realized that with regard to radon communication the web site was not the best focus for the campaign but rather the "local dimension". That is to say rather than contacting

"a central station of information" small home owners followed the discussions on radon in the local newspapers (as part of the media campaign) in which not only the Board was mentioned but also more importantly the individual responsible for radon sanitation in that municipality in question. The municipality inhabitants felt much more comfortable contacting their municipality representatives themselves who had local knowledge of the radon problem rather than visiting an anonymous central website. This was seen in the meta analysis and confirmed by earlier research regarding the importance to focus on the rich "local landscape, place and identity" as argued by social anthropologists and geographers over many years (see, for example: Bender 1993; Entrikin 1991; Firey 1945; Hirsch and O'Hanlon 1995; Lovell 1998).

7. What should the Board do now in terms of radon communication?

In 2013 the European Commission passed a Directive on reducing radiation in Europe (EU Directive 2013/59). Each of the member states need to provide a reply to the Commission by February 2018 at the latest on how they plan to implement that Directive. In Sweden, the Swedish Radiation Agency is leading the nation's reply to the European Commission and as part of that the Board is also involved. Among the issues stressed in the Directive is the need for a proper thought out radiation communication strategy associated with radon. Based on this the Swedish National Board of Housing and Planning officials take the view that there is a high chance that by 2018 there will be a new radiation reduction budget in place as well as a proper communication programme. For that to be successful the Board needs to address the three criticisms raised above namely:

- Any campaign needs to be underpinned by proper risk research and risk communication science ideally conducted by an academic body rather than by a communication consultancy;
- Focus on the long-term rather than just do a "snapshot";
- Have a strong local dimension rather than attempting to push all the small house owners to yet another central webpage;

8. Conclusions

Overall when the Swedish National Board of Housing and Planning has had a proper communication/information budget the Board has been successful with regard to communicating the risks associated with radon, leading to homes being measured and ensuring that individuals apply for up to half the costs associated with radon sanitation measures. When the Board has not had these funds it has not been successful. Going forward with Sweden and the other

nations attempting to come to terms with the EU Radiation Directive, it is hoped that the Government will set up a new radon sanitation fund. The results of this study show how budgets can be better directed to improve campaign effectiveness. In the meantime, what is clear now is that the Board will only reach parts of the Government's generation goal regarding reducing radon set out in the important Government Bill of 2001. Schools and larger dwellings will meet the Government set radon standards, but single family dwellings will not (Swedish Board of Housing and Planning 2009 and 2010b), as there is no radon sanitation budget. As a result, radon pollution in some shape or form will continue to cause radon-induced lung cancer in some 500 Swedes per annum until new measures are taken.

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